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COLOUR VISION.

Researches in Colour Vision and the Trichromatic Theory. By Sir William de W. Abney, K.C.B., F.R.S. Pp. xi+418+5 plates. (London: Longmans, Green and Co., 1913.) Price 21*s.* net.

THERE is certainly no living authority on "colour-vision" more competent to throw light on that intricate and perplexing subject than the author of this work. Sir William Abney has attacked the various problems which present themselves by his own methods and with the utmost completeness of detail. In almost every conceivable way he has tried to correlate the more precise physical facts, elicited by carefully and ingeniously modified experiments, with the vaguer physiological conceptions arrived at from a study of normal and abnormal sensations of colour. The present work embodies and collects into a consecutive whole a record of the author's previously published researches. The book is consequently one which will be regarded as a standard work. It gives the most complete and clear exposition of the trichromatic theory of Young-Helmholtz. It will, we venture to think, be more readily understood than Helmholtz's own latest treatment of the subject as given in the last edition of his "Physiological Optics."

So far as Sir William Abney's researches go, it must be admitted that they afford strong evidence of the fitness of the trichromatic theory to explain how normal colour sensations may be evoked by the known physical causes. The difficulty comes in attempting to explain congenital and acquired defects in colour sensation in accordance with that theory. To do so by inferring that there is then a complete absence of stimulability, or a weakening in the stimulability, of one of the three end-organs supposed to correspond to a so-called "fundamental sensation," leads to hypothetical conclusions as to the way in which colours are perceived by the colour-blind. The many interesting experiments adduced by the author in support of the idea of altered stimulability of the end-organs in the colour-blind can scarcely be said to be convincing. It may indeed be asked: Why should abnormal colour "sensation" depend at all upon abnormal "stimulability"? There are different stages in the production of colour sensations in response to objective stimuli. These are: the effect of the physical cause on the percipient elements of the retina, the conduction by the optic nerve, and, lastly, the response in the brain-cells. Might not an abnormality in the last stage, the final "response," be consistent with colour confusion complete and incomplete, altogether independent of any abnormality in the colour end-organs of the retina? In cases of acquired colour-blindness there is, in fact, good reason to refer the defect both to altered conductivity in the optic nerve-fibres and to changes in the central cells.

From the way in which colours are matched by the "colour-blind" it is difficult, apart from theory, to believe that the colour-blind spectrum is such as would appear to the normal eye anything remotely comparable to that represented for a "red-blind" and a "green-blind" individual respectively in plate i. Even admitting that there is an appreciable difference between the two classes of cases, which are thus classified in accordance with theory, it is almost inconceivable that the spectrum can appear so different in the two cases.

Some colour-blind people, is true, are unconscious or only vaguely suspicious of their condition. But there are others who are well aware of it. Some are even keenly interested in analysing their colour-impressions and in comparing them with those of normal individuals. The writer of this notice has met with several who have done so. Without exception and without regard as to whether they might be classified as "red colour-blind" or as "green colour-blind," they have arrived at the conclusion that their yellow and blue sensations are not materially different from the normal. Their absolutely dichromatic spectrum consists of a "warm" and a "cold" colour sensation, which, when saturated, as compared with other colours to them, are often described as "vivid" and "pleasurable."

In a letter received in 1879 from Dr. William Pole, who was "colour-blind" and well known for his own contributions to this subject, he states:—"I am more than ever convinced of the enormous difficulty normal-eyed persons find in understanding what we, the colour-blind, really see." Again, in 1890, referring to Clerk Maxwell, he says:—"He examined me carefully with spectral apparatus, but he spoilt all his results by insisting that my warm colour must be the Young-Helmholtz fundamental 'green,' and as I obstinately refused to adhere to what seemed to me a preposterous contradiction of all my experience, he never published his trials. . . . Now the general opinion seems to agree with my own impression that it is yellow, *i.e.* no Young-Helmholtz fundamental at all."

Again there is surely no proof that the colour-blind see white otherwise than the normal-eyed. No difference in a white object can be seen as it is passed from the periphery of the field of vision

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to the centre. Yet there is a colour-blindness of the normal peripheral field which is analogous to, though possibly not identical with, congenital colour-blindness. One of the assumptions, however, which is made, in the endeavour to make the theory suit the case of colour-blindness, is that the colour-blind "white" is altogether different from the normal-eyed "white." According to Sir William Abney, the "white" of the "red-blind" is a sea-green, and that of the "green-blind" a brilliant purple. But it would appear from the nature of the actual experiments on which this assumption is based (pp. 273, 274) that there is here only a confusion between the sensations to which these colours give rise in normal eyes and the *neutral* sensations which they evoke in the colour-blind.

In every case of complete colour-blindness (which causes colour-confusion only and is distinguished, therefore, from total loss of any colour perception) there are two hues which, though most definite and vivid to the normal-eyed, appear altogether uncoloured or neutral. Only one of these neutrals is to be found in the spectrum, though both can be produced by combinations of spectral colours. This is obviously something different from a demonstration of the manner in which what to the normal eye is white is seen by the colour-blind. But it may be asked: Is there any reason for entirely giving up the trichromatic theory because it does not meet with general acceptance when "doctored" to suit the case of colour-blindness? A study of Sir William Abney's work must convince one how strongly it is supported by physical facts.

A quotation from the preface may fittingly conclude a necessarily too short notice of this valuable and comprehensive work. The author there makes the following suggestive remark:—

> "A theory, to be one of perfection, must offer the truth, the whole truth, and nothing but the truth. The trichromatic theory offers the truth; but the physiologists must add their quota to make it the whole truth. There may be difficulties in welding together the physical and physiological aspects of colour vision to make a perfect theory, but it will be effected."

A MEDIEVAL PHYSICIAN.

John of Gaddesden and the Rosa Medicinae. By H. P. Cholmeley. Pp. 184. (Oxford: Clarendon Press, 1912.) Price 8*s*. 6*d*. net.

OLD books, at any rate old medical books, may, as regards their contents, be divided into three classes: those intrinsically valuable as sources of more or less original knowledge—of such are the Hippocratic writings, Galen, Alexander of Tralles, some of the Salernitan treatises, the greater medieval Italian and French surgeons, Sydenham, Morgagni—names taken at hazard; secondly, those which, although not original sources, yet enshrine more or less admirably the works of great men or of schools which had otherwise perished—of such are Celsus, our chief resource for the doctrines of Alexandrian medicine, or Cælius Aurelianus, which preserves for us some of the writings of Soranus, or Aretæus, or Oribasius—names again chosen at random, or smaller books which also, as rafts or broken pieces of the ship, may salve lesser fragments of ancient lore—books such as Aetius or Paul of Ægina; and, thirdly, old books which have no other value than the bibliophile may, in the fashion of the time, choose to confer upon them as antiques. These books, for their quaintness, may arouse some interest, and of such is the book before us.

John of Gaddesden's book may in its time have served as a handy "Practica" for his contemporaries, but in later centuries probably the best use it has served is as a nucleus around which Dr. Cholmeley has gathered much interesting historical matter, very aptly and pleasantly put together. The original John is poor stuff. His editor respectfully offers to him some tribute, asking us to recognise at least his clinical insight. John, who died in 1361, highly educated at Oxford and in later life a fashionable Court physician, enjoyed great advantages of experience, and no doubt brought these advantages to the construing of his Oxford "Theoretica" and "Practica"; but his own contributions were exiguous. Arderne, if no great author, was at any rate superior to John of Gaddesden, and we hope that the success of this edition may tempt Dr. Cholmeley to follow up Mr. D'Arcy Power's pioneer work with a like volume on Arderne.

In studying the writings of early physicians we must continually remember that literary ethics was not born until modern times—almost in our own day. It is scarcely fair to these old men, when they lifted pages upon pages from their forerunners, to accuse them of "shameful plagiary." They all did it, and not in medicine only; and not only the inferior authors, but the most reverend of them also. So John, with a pious obsequiousness, helped himself to what he could find elsewhere to serve his purpose. As a specimen of John's wonderfully vivid clinical pictures, Dr. Cholmeley quotes his description of obstructive jaundice with ascites. It is vivid, no doubt; but we may be sure that it is not John's. To track out the sources of all or many of his purple patches would be a long business, but in respect

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